

ture. The brace can be in the form of truss, such as a two-dimensional truss. The truss can be connected to the extension structure by at least one bearing allowing both rotational and translational motion of the extension structure relative to the truss. This at least partially reduces the transmittal of any torsional forces or out of plane stresses into the truss as the extension structure moves in response to environmental loads or forces such as waves. The at least one bearing can comprise a bushing attached to the extension structure, and the truss can be connected by two of said bearings, and wherein the bushings of each bearing are substantially parallel to each other to allow relative vertical movement of the monocolumn (22) to the truss (50). Alternatively the truss could be in the form of a three-dimensional design.

[0016] According to another aspect of the invention, there is provided a kit for extending an offshore structure, the offshore structure being supported via a foundation on a seabed, the kit comprising: an extension structure comprising a platform extension positionable laterally of a main platform of the offshore structure; and a platform extension support depending downwardly, in use, from the platform extension so as to come into contact with a foundation of the main platform, to support the platform extension directly on the foundations of the offshore structure

[0017] According to another aspect of the invention, there is provided a method of extending an offshore structure, the offshore structure comprising a main platform supported via a foundation on a seabed, the method comprising: providing an extension structure, comprising a platform extension and a platform extension support; positioning the platform extension laterally of the main platform; and positioning the platform extension support, depending downwardly from the platform extension, in contact with the foundation so as to support the platform extension directly on the foundation.

[0018] According to another aspect of the invention, there is provided a bearing for permitting rotational and translational movement, the bearing comprising: an outer bearing element; an inner bearing element having an inner bearing surface and an outer bearing surface; and a bushing; wherein the inner bearing element is provided within the outer bearing element and bears against the outer bearing element along the outer bearing surface, such that the inner bearing element is free to rotate in at least two orthogonal directions; and wherein the bushing extends through the inner bearing element and the outer bearing element, such that the inner surface of the inner bearing element bears against the bushing and can undergo translation motion with respect to the bushing.

[0019] According to this aspect, a bearing that allows both rotation and translational movement between, for example, an offshore extension structure and a brace to an original structure. This reduces the transmission of torsional forces and stresses into the brace and original structure, and thereby helps reduce fatigue. As such, the bearing is well suited to use in offshore activities.

[0020] The outer bearing surface can be substantially the surface of a spherical segment. That is, the surface can be part of a spherical surface. The inner bearing surface can be substantially cylindrical. This allows a high degree of freedom of movement in the bearing.

[0021] The bearing can further comprise a housing providing a seal around the inner bearing member, outer bearing member and the outer surface of the bushing. The housing comprises a flexible section to allow the bearing to move, in

use. The flexible section can, for example, be in the form of a bellows, allowing the housing to stretch and change shape as the bearing moves. These seals protect the bearing assembly from environmental contamination.

[0022] The bearing can further comprise a lip seal between the inner bearing member and the outer bearing member, and/or a flexible bellows housing lip seal between the inner bearing member and the bushing. This helps isolate the bearing surfaces from dirt or other substances that might increase the friction on the bearing surfaces, and therefore reduce the efficacy and life of the bearing.

[0023] The present invention is described below, by way of example only, with reference to the accompanying Figures, in which:

[0024] FIG. 1 is a drawing of an offshore structure, incorporating an original structure and an extension;

[0025] FIG. 2 is a drawing showing how the extension and original structure of FIG. 1 interconnect;

[0026] FIG. 3 is a schematic cross-section view of an alternative arrangement for connecting an extension and original structure;

[0027] FIG. 4 is a drawing of an extension connected to a truss section that extends from the original structure;

[0028] FIG. 5 is a close-up view of the connection between the extension and the truss section of FIG. 4;

[0029] FIG. 6 is a schematic representation of the bearing joint between the truss section and extension of FIGS. 4 and 5; and

[0030] FIG. 7 is a more detailed schematic cross-section of the left-hand side of the bearing joint of FIG. 6.

[0031] As discussed above, the present invention is concerned with providing a new way of extending existing offshore structures.

[0032] FIG. 1 shows a perspective view of an offshore structure (1), which comprises an original structure (10). The original structure (10) is a structure that is fixed to the sea bed (30). The original structure (10) comprises a main platform or deck section (11), which is supported above the sea surface. Although not shown in detail in FIG. 1, the main platform (11) will usually support equipment necessary for performing the normal functions of the offshore structure (1).

[0033] The main platform (11) is supported via a foundation (40) on the seabed. In FIG. 1, the main platform (11) is supported by the jacket section (12). Typically, such jacket sections (12) can be constructed from steel sections welded together, and are made from tubular sections that are cross-braced against each other. As can be seen in FIG. 1, the jacket section (12) may comprise leg sections (13) which extend from the sea floor (30) to the deck section (11). These legs (13) are then strengthened by the use of braces (14).

[0034] The jacket section (12) includes the foundations (40). Foundations (40) typically comprise piles (41) (see FIG. 2) which are driven into the sea floor through steel tubes (42) formed in the foundations (40).

[0035] Pilings (41) are typically steel tubes that are driven into the sea floor. The pilings (41) typically have a reinforced, machined, top end that has a thicker tube wall (for example 100 mm instead of 70 mm) for the purpose of driving the piling down into the sea floor

[0036] In some cases, pilings (41) are not driven all the way into the sea floor, but are driven to the point at which they can be driven no further or have achieved the required penetration per hammer blows to meet designed capacity. In that case, the unused length of piling (41), not driven into the foundations,